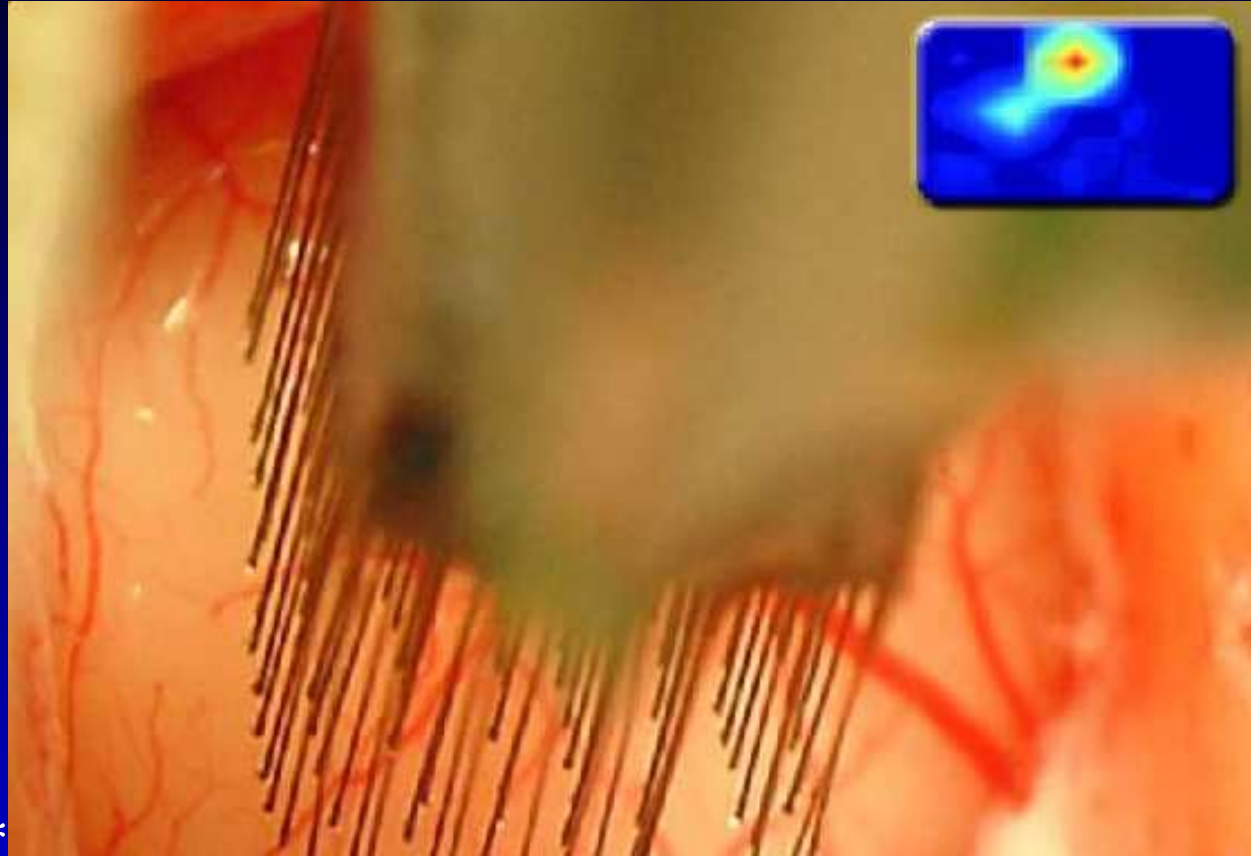


VISIT...

LANZAROTE
Caliente.COM

Neuroprosthetics *₌



Hecke

MPI für Dingsbums Göttingen



Overview

1. Introduction



Overview

1. Introduction
2. Existing Neuroprosthetics



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3. Research areas



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4. Experiments



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4. Experiments
5. Outlook



Introduction

Five principles for the design of Neuroprosthetics:



Nicolelis, M. A. L. (2003) *Brain-machine interfaces to restore motor function and probe neural circuits* .

Introduction

Five principles for the design of Neuroprosthetics:

- ★ Motor information is distributedly represented



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Five principles for the design of Neuroprosthetics:

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- ★ Multiple motor parameters can be extracted in real time



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Five principles for the design of Neuroprosthetics:

- ★ Motor information is distributedly represented
- ★ Multiple motor parameters can be extracted in real time
- ★ Therefore recording a few hundred neurons is sufficient



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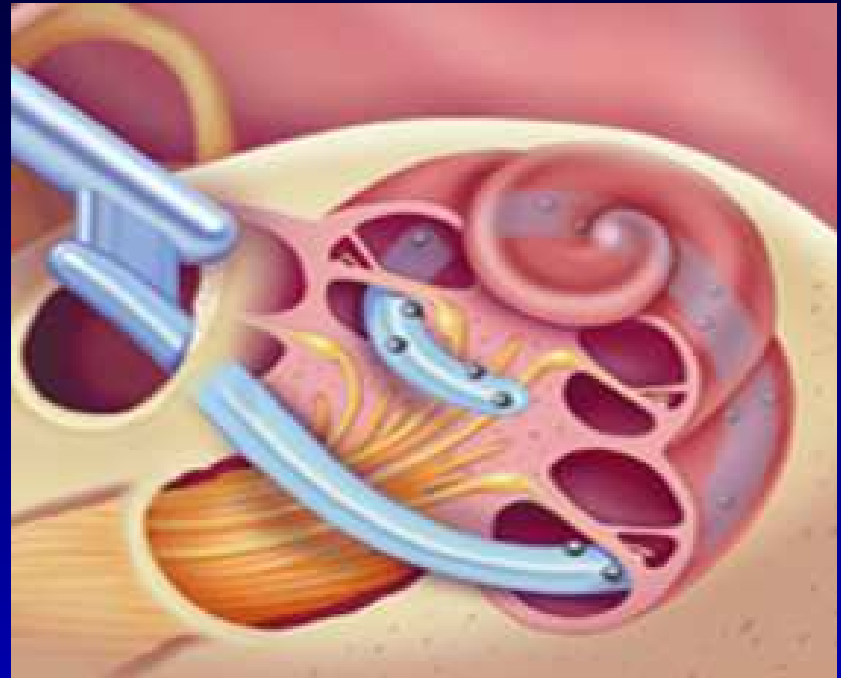
- ★ Motor information is distributedly represented
- ★ Multiple motor parameters can be extracted in real time
- ★ Therefore recording a few hundred neurons is sufficient
- ★ It has to be taken advantage of plasticity of the structure
- ★ Different patterns can encode the same movement



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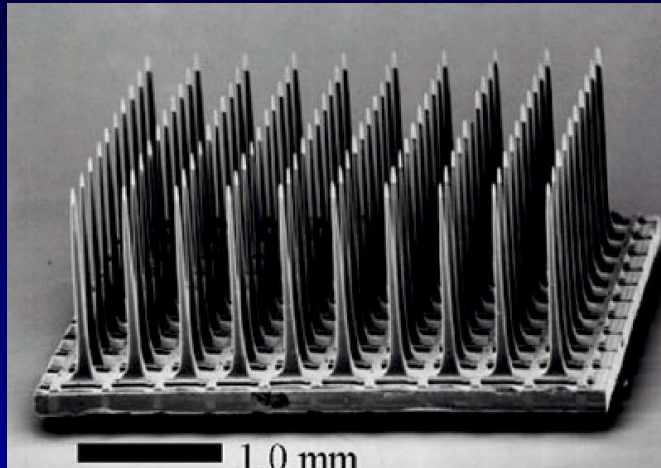
Example for NP

Cochlear implants:



Research areas: measuring

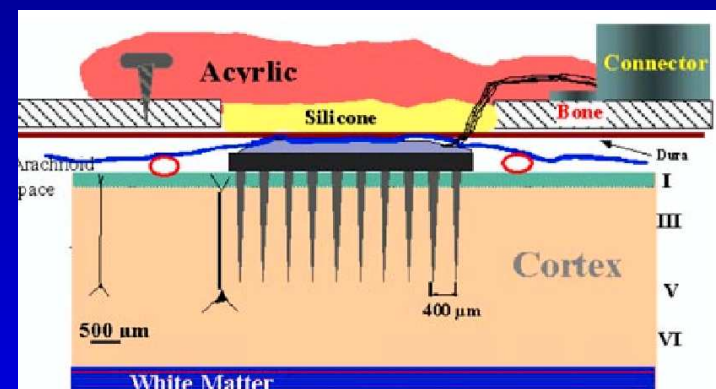
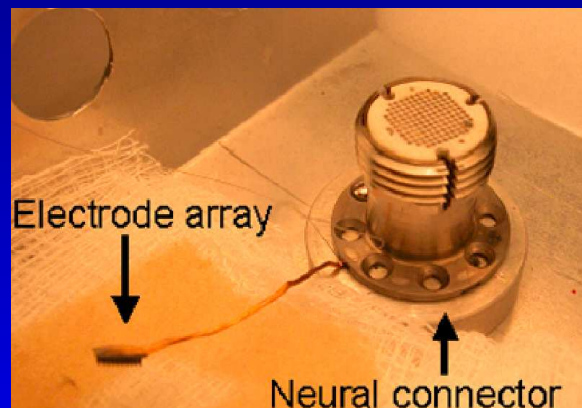
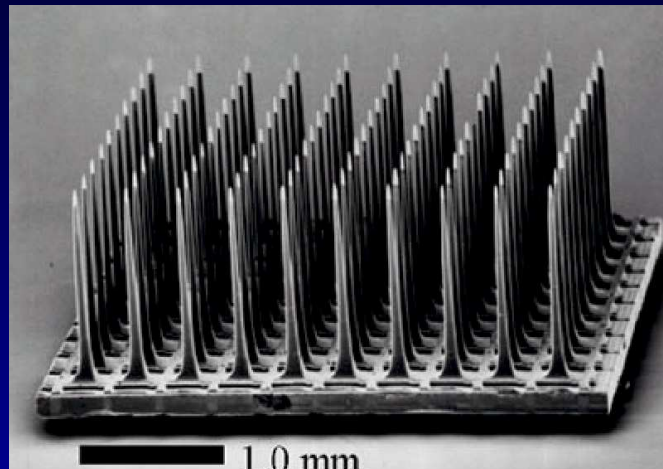
The first step is to extract information out of the brain.



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coding and decoding

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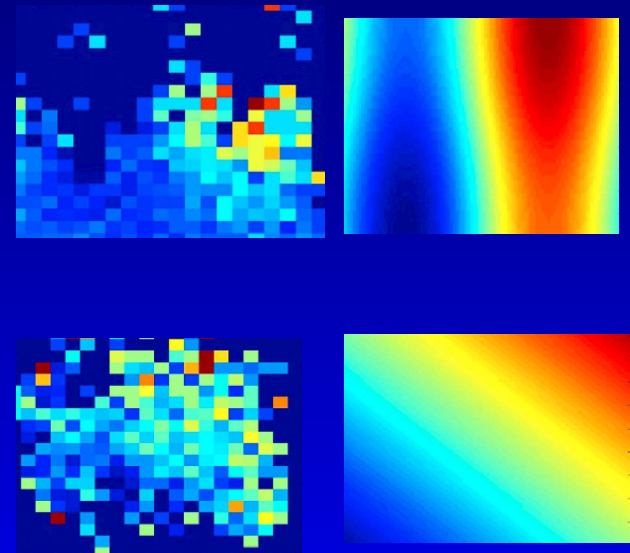


coding and decoding

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ANN's: don't care about the representation

Kalman Filters: benefit from the linear dependence of the firing rate to hand motion direction and to position and acceleration.



actual questions

- ★ User friendliness of interfaces
 - as the pair hand movement - mouse pointer



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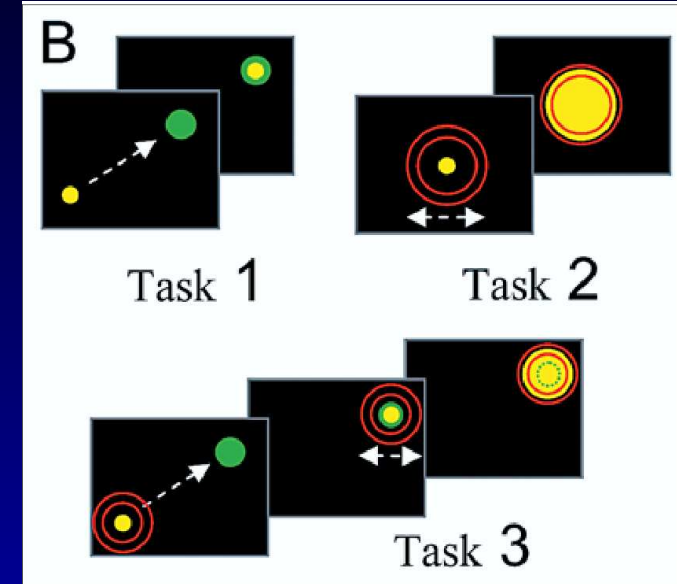
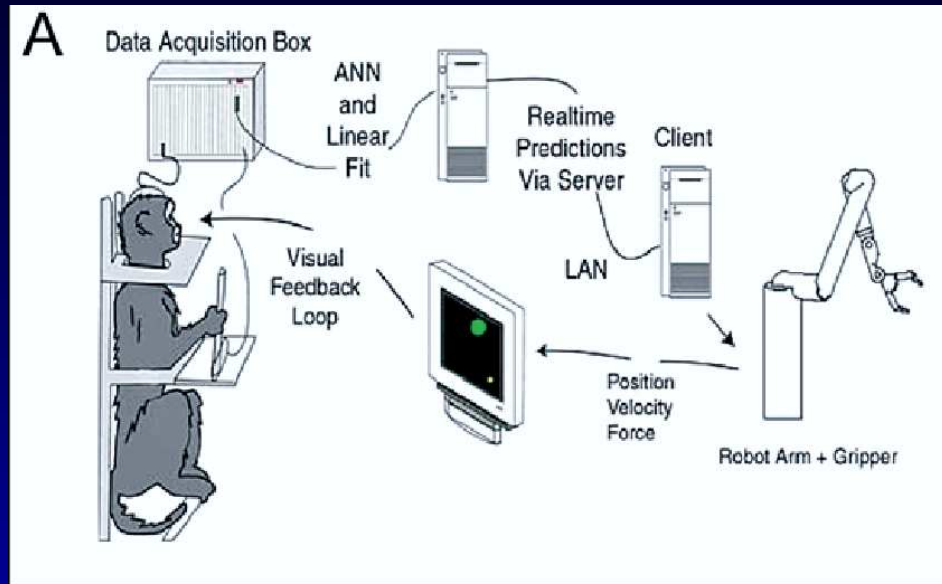


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- ★ Mobile robot platform for wheelchairs
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- ★ Implants in humans?



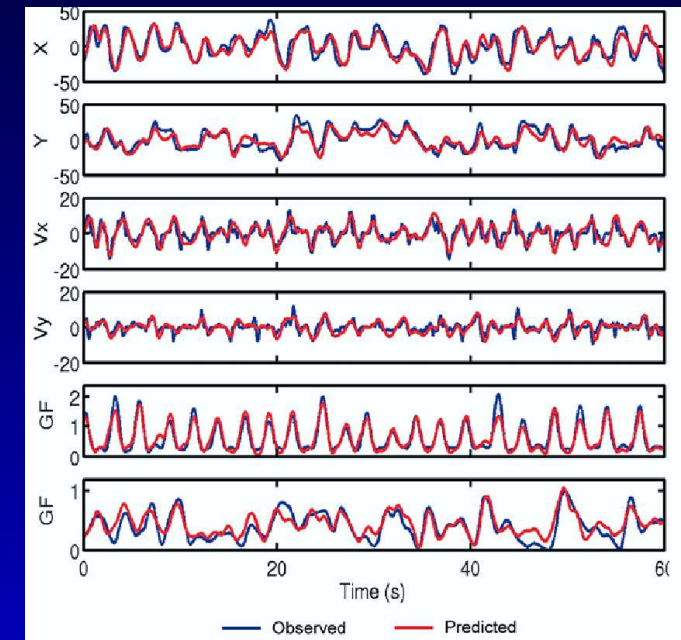
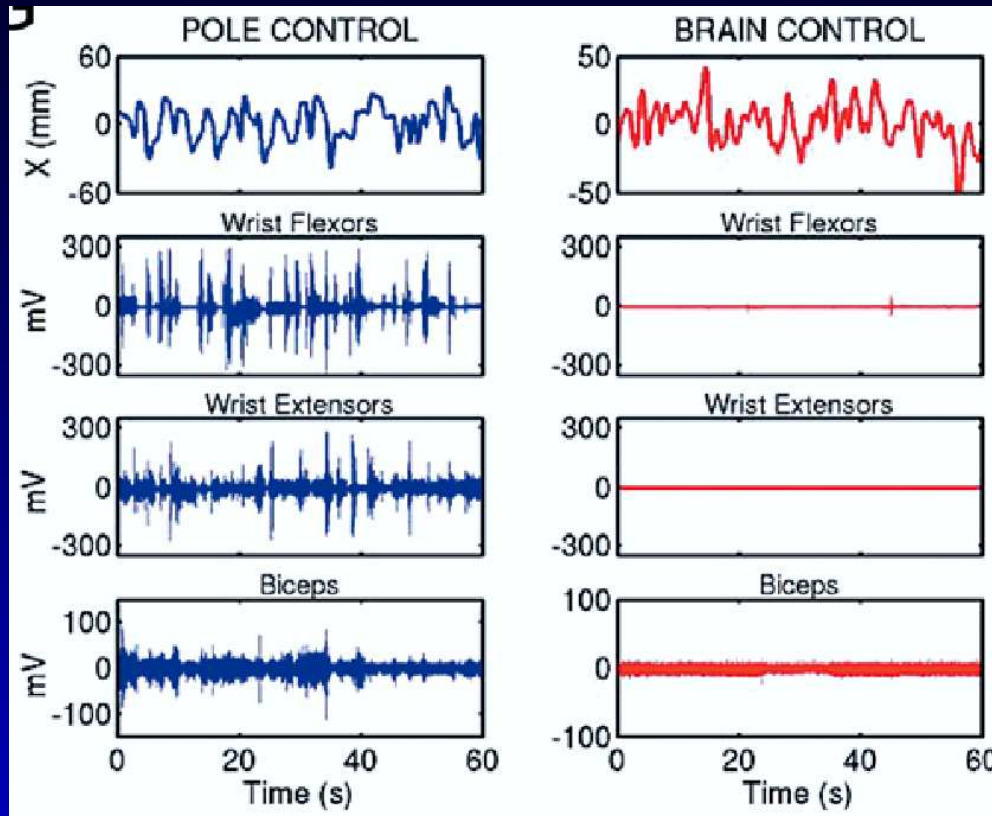
Ex 1: Reaching and grasping



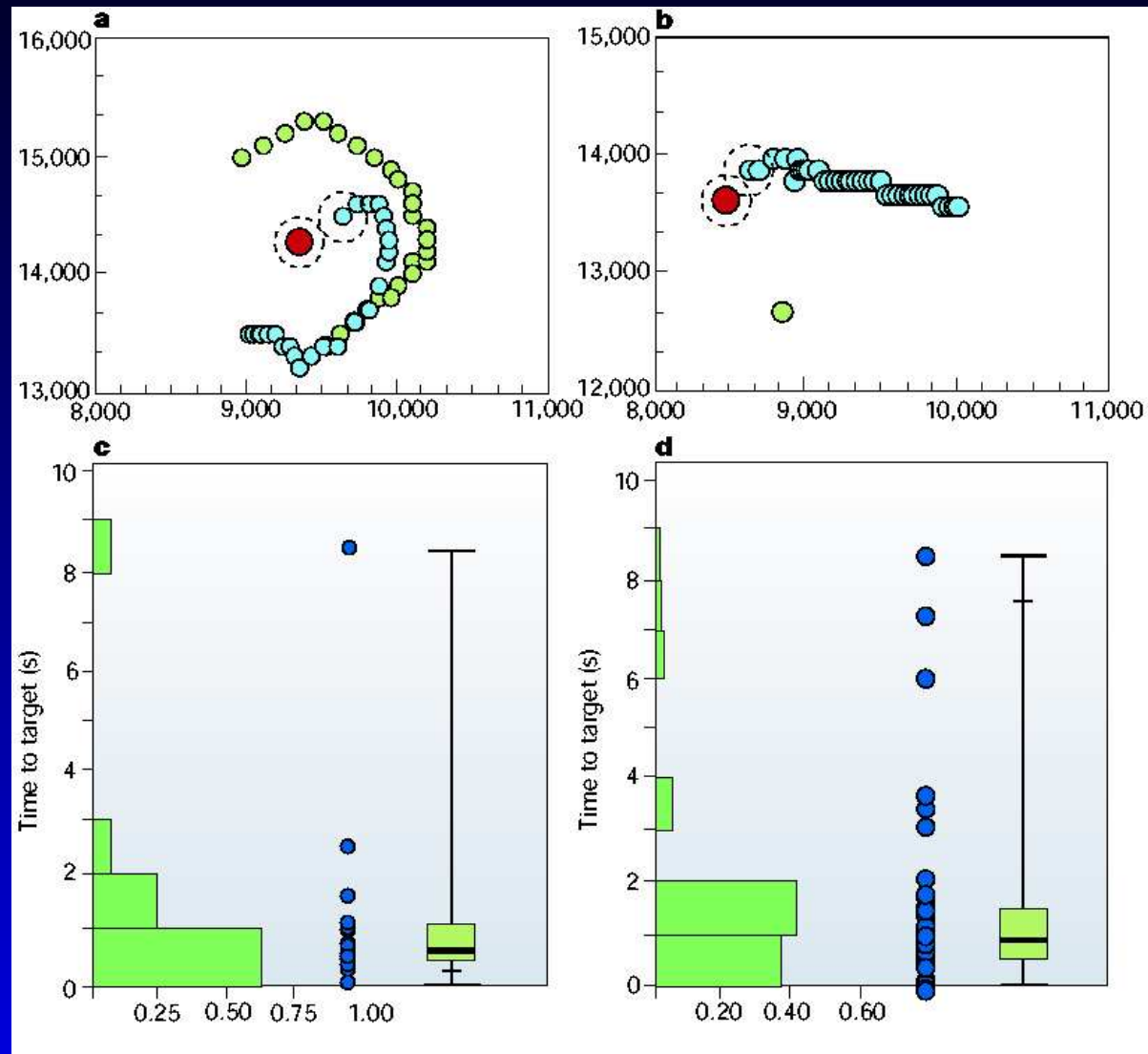
- ★ adaptation to direct cursor control
 - ★ fast adaptation to the dynamics of the robotic arm
- > simulation



Prediction performance



Experiments 2



Exp 3: Remote controlled rat

- ★ Provide control signals via microelectrodes to the primary somatosensory cortex



Talwar et al. (2002) *Rat navigation guided by remote control.*

Nicolelis M. A. L. (2002) *The amazing adventures of Robotrat .*

Exp 3: Remote controlled rat

- ★ Provide control signals via microelectrodes to the primary somatosensory cortex
- ★ either to the left or the right whisker representation, meaning "Turn left!" or "Turn right"



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- ★ Provide control signals via microelectrodes to the primary somatosensory cortex
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Applications:

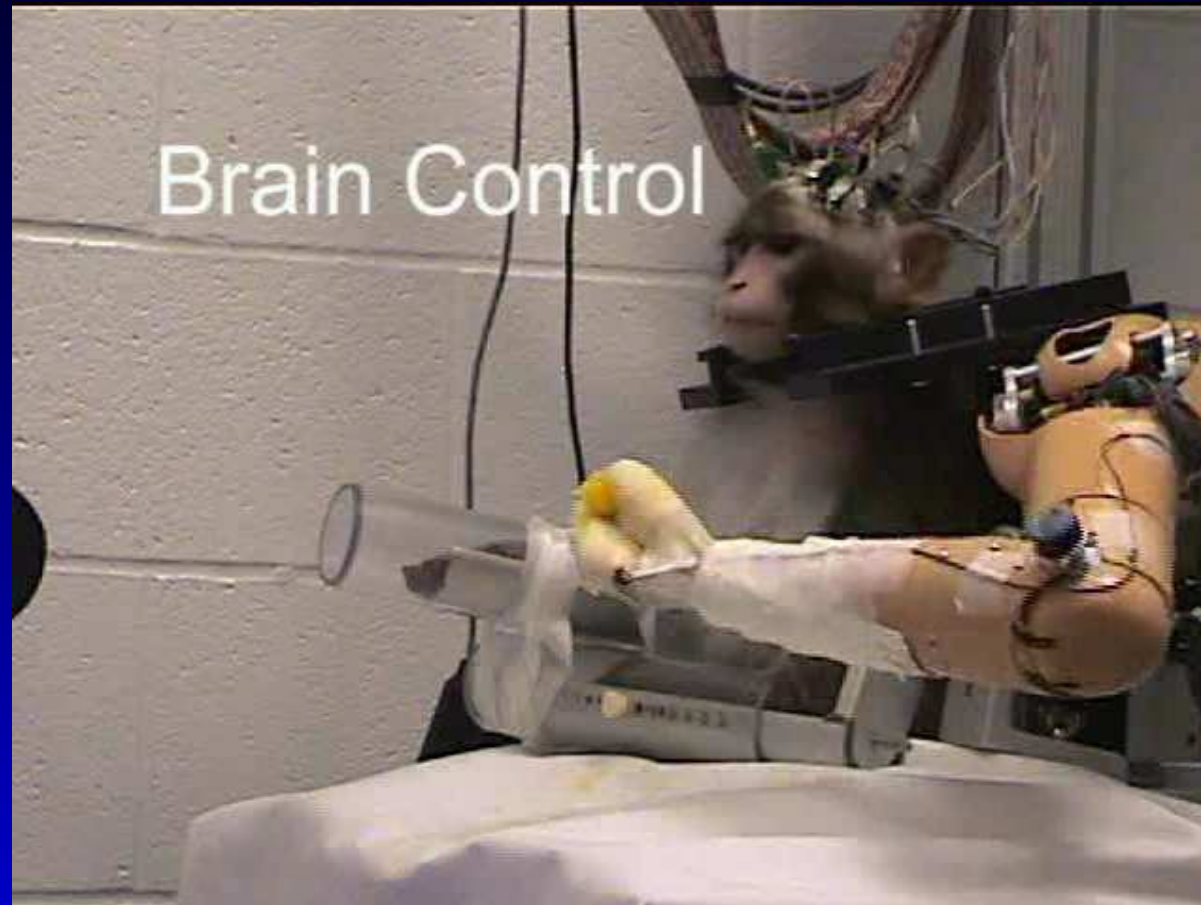
- ★ locate individuals for rescuing
- ★ Feedback of Neuroprosthetics to the nervous system

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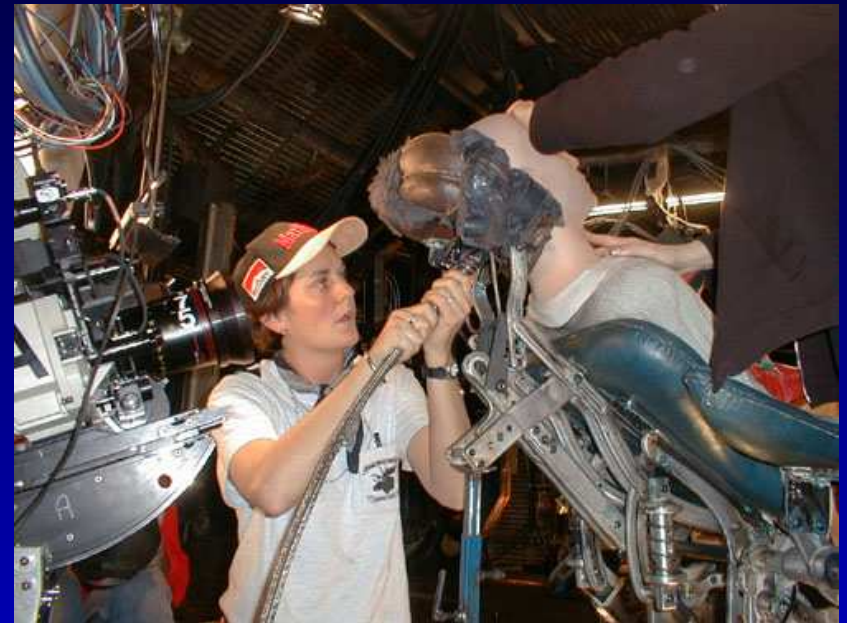
Experiments 4



-> Video by Andrew Schwartz



Outlook



Silver J. (1999) *The Matrix*.